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FORM NO. 51-4C
MAR 1952

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CENTRAL INTELLIGENCE AGENCY
INFORMATION FROM
FOREIGN DOCUMENTS OR RADIO BROADCASTS

REPORT

CD NO.

COUNTRY USSR

SUBJECT Scientific - Electronics

HOW PUBLISHED Monthly periodical

WHERE PUBLISHED Moscow

DATE PUBLISHED Aug 1953

LANGUAGE Russian

DATE OF INFORMATION 1953

DATE DIST. 11 Dec 1956

STAT

NO. OF PAGES 8

SUPPLEMENT TO REPORT NO.

THIS IS UNEVALUATED INFORMATION

SOURCE Vestnik Svyazi, No 8, 1953, pp 3-5

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NEW POWERFUL PRIMARY CELLS

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set of electrodes is fastened to an iron welded container 1, which is tightly covered by iron cover 2. Positive electrode 3 is in the form of a parallelopiped ("briquette"), consisting of several electrode plates fastened together. The latter are made by pressing against an iron grid an active mass made of a mixture of powdered activated carbon (from wood or from semicoke) and a thermoplastic binding material with a hydrophobic additive. The technology of manufacturing electrode plates is the customary one used for mass producing electrotechnical parts from plastics.

The upper portion of the positive electrode is tightly fastened with clamping pins in a box-like holder 4, welded to the cover of the cell. Inside the holder, over the upper surface of the electrode, there is a free space (air chamber), which is connected with the outside air through a "breathing" hole 5. The positive electrode is surrounded by cast-zinc electrode 6, in the form of a rectangular ring with rounded corners.

The potassium hydroxide needed for the preparation of the electrolyte is placed in space 7 during the manufacture of the cell. Since the hermeticity of the cell does not permit any noticeable carbonization of the potassium hydroxide, the latter can be stored for an unlimited time. To put the cell into operation it is necessary to remove the cover with the electrodes and to pour a certain quantity of ordinary drinking water into the cell. Once the potassium hydroxide is dissolved and the solution cools down the cover is again put on. During the time that the cell is in operation the air enters through the "breathing" hole in the cover. The oxygen of the air, absorbed by the carbon of the positive electrode, then diffuses towards the surfaces of the electrode which is in the electrolyte.

The electromotive force of the cell is approximately 1.4 v. The VDL cells, like other primary cells, are designed to operate at relatively long discharge schedules. A 1,000 -- 1,500-hour discharge is normal for such cells. The initial voltage under a normal schedule is 1.20 -- 1.25 v; the voltage at the end of the discharge is 0.90 v.

After complete discharge the carbon electrode maintains its operating ability and the cell can be restored by replacing the zinc in the electrolytes. This does not change its discharge capacity. Such restoration can be carried out twice.

Type VDL-2 (rectangular) and VDL-K-2 (cylindrical) cells with a nominal capacity of 800 ampere-hours (actually 900 -- 1,000 ampere-hours) at a drain of 0.5 a are intended for supply of kolkhoz radio centers. The VDL-3-G cell, with a nominal capacity of 500 ampere-hours, (actually 600 -- 800 ampere-hours) is intended to serve as A-battery for individual radio receivers. The nominal specific capacity of the cells of the VDL-K-2 type reaches 180 ampere-hours per cu m of total volume. The Scientific Research Institute of the Ministry of Electric Stations and Electric Industry on the basis of the VDL-3-G cell has constructed a cell of somewhat smaller size, namely VDTs-500. It has a capacity of 500 ampere-hours, better hermeticity, and a specific capacity that is 20% higher.

Figures 2 and 3 show the constructions of the VDL-K-2 and VDTs-500 cells. The principal data on the VDL cells are given in the table.

[See table, following page]

In addition to the cells indicated in the following table, a more powerful cell, type VDL-4, with a capacity of 1,000 ampere-hours at a drain of 2 a, has been developed.

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is approximately one half that of an ordinary dry cell. If the difference in the actual service life is taken into account, the zinc consumption per ampere hour of useful capacity turns out to be 3 times smaller. Among the advantages of VDL cells is their long shelf life and the possibility of restoring the cell. Mention must also be made of the fact that according to a suggestion by A. A. Severov a simple method was developed for the regeneration of the zinc and of the electrolyte of discharged VDL cells.

Experiments on the use of VDL-2 and VDL-K-2 cells to supply kolkhoz radio stations of the UB-5 and KRU-2 type yielded satisfactory results. The power pack of the KRU-2 station consists of 11 VDL-K-2 cells. Ten cells are used in series to supply the vibrator converter and one cell is used as an A-battery. The service life of such a pack is 7 -- 12 months, operating 5 -- 8 hours a day.

The VDL-3-G cells were tested on artic expeditions. On 2 expeditions the cells were used for the base radio stations and produced good results. In the third expedition the cells were operated by a geological field party and were transported under conditions where they were subject to severe vibrations. Since the construction of the cells was designed only for stationary operating conditions, they did not function normally in the latter case, owing to their incomplete hermetization.

A battery of 22 VDL-2 cells was also operated in an 8-line automatic telephone station for intrarayon communication in the Leningrad Oblast'. The average battery current was approximately 0.6 with short-period peaks of up to 2 a; the average daily current drain measured with a volt-meter was approximately 5 ampere-hours. During 17 months of experimental operation the battery supplied the station without interruption. During this period the battery was restored twice and thus operated for 3 cycles, delivering an approximate total of 2,500 ampere-hours. During operation the battery required no maintenance whatever.

Type VDL cells can also be used to supply 20-line automatic telephone stations. For a 20-line automatic telephone station with a supply of 24 v a battery consisting of 2 or 3 parallel groups of 22 VDL-K-2 cells each is required. It is more advantageous to employ 3 groups (66 cells), for this insures a longer operating period for the battery without restoration. The actual capacity of the battery for 3 operating cycles is not less than 2,500 x 3 = 7,500 ampere-hours.

Since the average daily current consumption in a 20-line automatic telephone station is 15 ampere-hours, such a battery guarantees station operation for 17 months. The battery can be placed on a small 3-shelf rack measuring 2 x 0.5 x 1.2 m.

The approximate cost of supply can be determined from the following data.

Cost of one VDL-2 cell by preliminary calculation (when regularly produced)	54 rubles
Cost of entire battery	3,564 rubles
Cost of materials (zinc electrodes and potassium hydroxide) for 2 rechargings	696 rubles

Taking into account also the cost of labor for the initial installation and filling of the battery (2 man-days) and for 2 rechargings (14 man-days) we find that the total cost for 17 months of station operation is approximately

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5,300 rubles. Thus, the annual supply cost does not exceed 3,750 rubles, or 15.60 rubles for each subscriber per month. If the cells are massproduced this cost will be reduced even more considerably.

Based on the data cited one can assume that an intrarayon communication automatic telephone station supplied by VDL cells can be employed in non-electrified localities.

The tests described above show that the VDL cells can be advantageously used not only for A-batteries of battery receivers but can be successfully used also to supply kolkhoz radio stations and small automatic telephone stations for intrarayon communication.

The new cells will substantially increase the technical and economical indexes of the battery supply and will provide a basis for their employment as simple and convenient sources of supply for communication and broadcasting apparatus of low capacity in nonelectrified localities.

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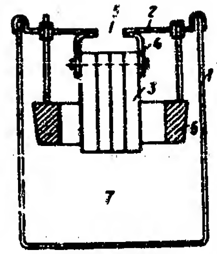

Figure 1

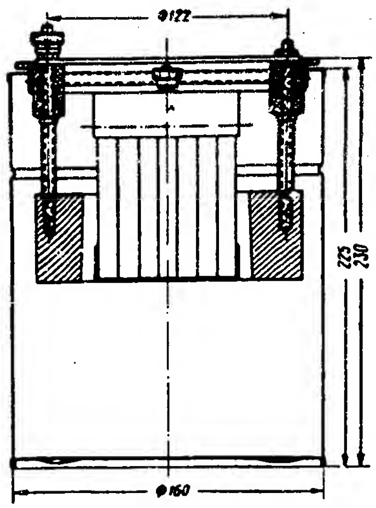

Figure 2

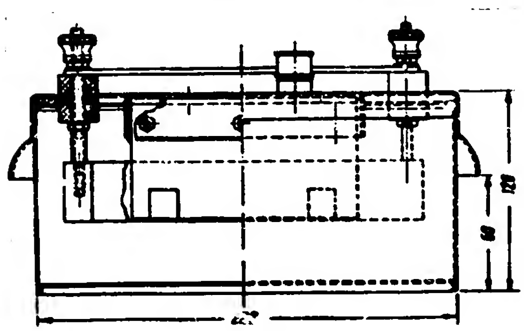

Figure 3

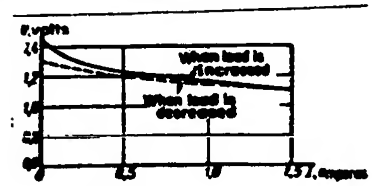

Figure 4.

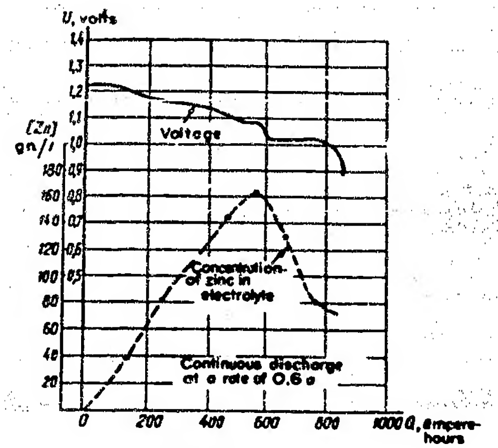

Figure 5

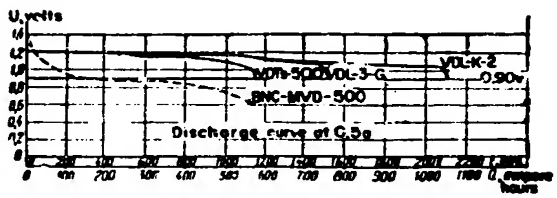

Figure 6

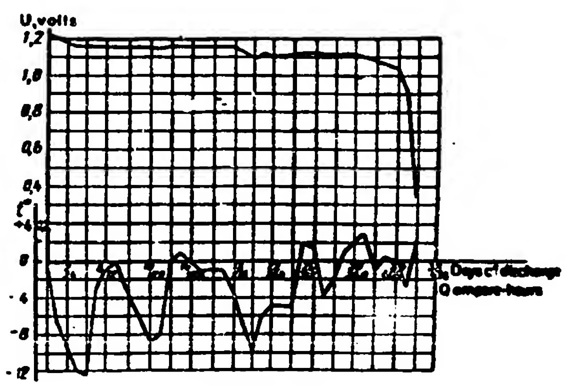

Figure 7

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